REMARKS

Status of the Claims

Claims 1, 3 – 13, and 27 are allowed. Claims 1, 3 – 13, 20 – 24, 26 – 32 are pending. Claims 2, 14 – 19, and 25 are cancelled. No claims are withdrawn.

Claim Amendments

New claims 28 – 32 find support throughout the specification as filed. New claim 28 finds support throughout the specification, including in paragraph [0066]. New claim 29 finds support throughout the specification, including in paragraph [0091]. New claim 30 finds support throughout the specification, including in paragraph [0092]. New claim 31 finds support throughout the specification, including in paragraphs [0055], [0060], and [00101]. New claim 32 finds support throughout the specification, including in paragraphs [0055], [0060], [0092], and [00101]. A typographical error is also corrected in claim 1.

Claim Rejections

The rejection of claims 20 – 22 and 24, citing 35 U.S.C. §102(e) or 35 U.S.C. § 103(a), and Chen et al., OrganoClay-Aerospace Epoxy Nanocomposites, 46th International SAMPE Symposium, May 6 – 10, 2001 (XP008051803) (hereinafter, "Chen") is traversed and should be withdrawn.

The Office Action acknowledges Chen fails to disclose steps a), b), and c) of claim 20 (See: OA at p. 4). Nevertheless, the Office Action alleges, "the instantly claimed modified epoxy is the same or an obvious variation of the one set forth in Chen et al. because the final product of Chen et al. satisfies all of the material/chemical limitations of the instant invention" (OA at p. 5). Applicants respectfully disagree.

Chen presents development of epoxy/clays. Epon 862 and curing agent W were used. Even though the name of epoxy and name of clays as well as the tests that are described may appear at first impression to be familiar, the products actually obtained by Chen and by the present invention are very different due to the use of different methods for producing these products. As described at page 367, last paragraph of Chen:

> ... while the fracture toughness and failure strain of the nanocomposites are reduced to some extent. Perhaps the key to improve the toughness of the nanocomposite is to enhance the interfacial interaction between the polymer matrix and layered silicates, which will be the focus of our efforts in later research.

Table 6 on page 373 of Chen shows that the stress intensity factor (a measure of fracture resistance) shows a value of Kq of 653 for the Epon 862/W virgin epoxy resin. This value is reduced for all of the epoxy resin containing the nanoclays (values of Kq between 398 and 606). As further shown in Table 6, the fracture strain also drops from 0.079 to about 0.04. The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'" MPEP §2112, citing In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). Thus, "[i]n relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original).

In the conclusion of Chen, the concern about fracture toughness is repeated again, as follows: "Perhaps the critical key for improving the toughness of the nanocomposite is to enhance the interface interaction by chemical covalent bonding. This will be our future research focus." Chen at p. 368.

The present invention shows that the epoxy/nanoclays nanocomposites exhibit increase in fracture toughness and fracture strain. Figure 22, reproduced below, shows that using the HPMM method, addition of 1.5% of clays improves the K1c (similar to Kq) from about 0.7 MPa.$m^{0.5}$ to about 1.3 MPa.$m^{0.5}$ (an increase of 88%).

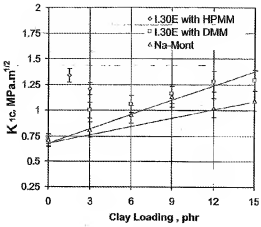

Figure 23, reproduced below, shows that for the system without rubber (CTBN), addition of 6 phr of clays bring the K_{1c} from about 0.55 MPa.m$^{0.5}$ to 1 MPa.m$^{0.5}$, again an increase of about 88%.

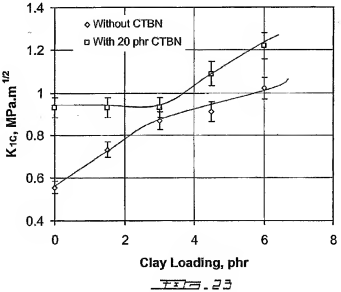

Figure 24, reproduced below, shows the value of strain energy release rate G_{1c} (another measure of fracture toughness) improving from about 75 J/m^2 to about 300 J/m^2 for 6% clays (4 times improvement).

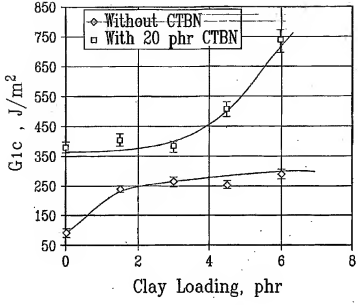

FIG. 24

In Figure 25, reproduced below, the same quantity is shown to improve from about 120 J/m^2 to about 600 J/m^2 (5 times improvement).

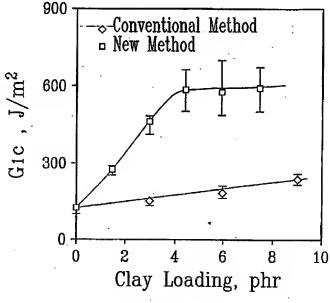

FIG. 25

In Figure 20, reproduced below, the fracture strain for the system without CTBN shows a slight improvement in the fracture strain.

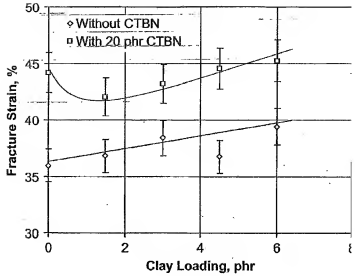

Fig. 20

Chen's product does not possess the characteristics of the presently claimed product.

Allowed claim 9 is directed to the method according to claim 1, whereby the modified epoxy has enhanced viscoelastic properties, improved fracture toughness, and critical strain energy release rate compared to the pristine epoxy. Allowed laim 11 is directed to the method according to claim 1, whereby the modified epoxy has enhanced barrier properties, including water absorption resistance, adhesion strength and flammability resistance, with respect to the pristine epoxy. Claim 20 is directed to a modified epoxy produced from a pristine epoxy, the modified epoxy having at least higher barrier properties and thermal resistance than the pristine epoxy.... Chen's product does not possess these characteristics.

Allowed claim 10, as well as claims 22 and 29 relate to modified epoxies, methods of producing modified epoxies and composite epoxies having an increase in K_{1C} and G_{1C} of up to 2 and 3 times respectively with respect to the pristine epoxy, at about 1 wt % of clay loading. Chen's product does not possess these characteristics.

Allowed claim 27, as well as new claims 30 and 32 relate to modified epoxies, methods of producing modified epoxies and composite epoxies having an increase in K_{1C} and G_{1C} of up to 2.2 and 7.6 times respectively at 6-phr organoclay loading and 20-phr CTBN compared with the pristine epoxy. Chen's product does not possess these

characteristics.

The problem of brittleness, i.e. low fracture resistance, of the epoxy resin is a large obstacle for damage tolerance in composite materials. Many efforts have been made by many people to improve the fracture resistance. The fracture resistance is exhibited by the fracture toughness. Even though Chen also produced epoxy/clay nanocomposites, Chen's product is different from the product of the present invention. Chen's product does not have similar performance in terms of fracture resistance than the product produced by the present invention. For that matter, many other people have also mixed clays and epoxies before, but their results are not good since they could not improve the fracture resistance. The present invention provides a new method that allows fabricating new products.

For at least these reasons, the rejection of claims 20 – 22 and 24, citing 35 U.S.C. § 102(e) or under 35 U.S.C. § 103(a) and Chen should be withdrawn.

The rejection of claims 23 and 26, citing 35 U.S.C. §103(a), Chen, and US 4,465,542 to Furihata (hereinafter, "Furihata") is traversed and should be withdrawn.

Claims 23 and 26 depend from claim 20. Furihata is not cited to compensate for Chen's failure to teach or suggest the modified epoxy as claimed in claims 20 – 22 and 24. Therefore, even if one of skill in the art had added rubber to the composition of Chen on the ground that Furihata recognises rubber materials as suitable modifiers for epoxy/clay composites, one of skill in the art would not have obtained the presently claimed product, as explained hereinabove in relation to claims 20 – 22 and 24.

For at least these reasons, the rejection of claims 23 and 26, citing 35 U.S.C. §103(a), Chen, and Furihata should be withdrawn.

Fee Authorization

The Director is hereby authorized to charge any deficiency in fees filed, asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account 14-1437. Please credit any excess fees to such account.

Respectfully submitted,
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